

REMARKS

In response to the Office Action mailed October 6, 2005, the Applicants respectfully request reconsideration. To further the prosecution of this Application, the Applicants submit the following remarks and have added new claims. The claims as now presented are believed to be in allowable condition.

Claims 1-20 were pending in this Application.

Claims 1-16 (Group I) were drawn to a circuit board component which provides EMI shielding. Claims 17-20 (Group II) were drawn to the process of making the circuit board component.

The Office Action references a prior telephone conversation with Applicant's Representative, David E. Huang, in which Mr. Huang elected Group I without traverse. Applicant hereby affirms the election of Group I without traverse, namely, claims 1-16.

By this Amendment, claims 17-20 have been cancelled and claims 21-28 have been added. Accordingly, claims 1-16 and 21-28 are now pending in this Application. Claims 1, 4, 5, and 14 are independent claims and the remaining claims are dependent.

Claim Objections

Claims 2, 3, 6, 7, 10, 15, and 16 have been objected to for various informalities. The claims have been amended to correct the informalities in accordance with the suggestions presented in the Office Action. The amendments do not add new matter to the application and do not raise new issues that would require further searching and consideration.

Rejections under §102 and §103

Claims 5, 14, and 16 were rejected under 35 U.S.C. §102(a) as being anticipated by U.S. Patent Publication No. US2003/0174478 to Oggioni et al. (hereafter Oggioni). Claims 1-4, 6-8, 10-13, and 15 were rejected under 35 U.S.C. §103(a) as being unpatentable over Oggioni in view of U.S. Patent Publication No. US2003/0122242 to Takeuchi (hereafter Takeuchi). Claim 9 was rejected under Oggioni in view of Takeuchi and further in view of U.S. Patent Publication No. US2004/0150102 to Lee et al. (hereafter Lee). The Applicants respectfully traverse each of these rejections and request reconsideration. The claims are in allowable condition.

Regarding the rejection of independent claim 5, the claim relates generally to a circuit board component that comprises a substrate having non-conductive material and conductive material supported by the non-conductive material, the conductive material defining (i) a circuit board interface, (ii) a die interface, (iii) a heat spreader interface, and (iv) a set of connections which interconnects the circuit board interface, the die interface and the heat spreader interface. The circuit board component also comprises a die coupled to the die interface defined by the conductive material of the substrate where the die includes integrated circuitry which is configured to electrically communicate with a circuit board when the circuit board couples to the circuit board interface defined by the conductive material of the substrate. The circuit board component also comprises a heat spreader coupled to the heat spreader interface defined by the conductive material of the substrate, the heat spreader being configured to dissipate heat from the die, the heat spreader in combination with the heat spreader interface forming an electromagnetic interference shield when a portion of the circuit board interface connects to a ground reference of the circuit board through the circuit board interface.

Regarding the rejection of independent claim 14, the claim relates to a circuit board component that comprises a heat spreader configured to dissipate heat from the circuit board component. The circuit board component also comprises a substrate having non-conductive material and conductive material supported by the non-conductive material, the conductive material defining (i) a circuit board interface, (ii) a die interface, (iii) heat spreader connecting means for physically and electrically connecting to the heat spreader, and (iv) a set of connections which interconnects the circuit board interface, the die interface and the heat spreader connecting means. The heat spreader and the heat spreader connecting means form an electromagnetic interference shield when a portion of the circuit board interface connects to a ground reference of a circuit board through the circuit board interface. The circuit board component also comprises a die coupled to the die interface defined by the conductive material of the substrate, the die including integrated circuitry which is configured to electrically communicate with the circuit board when the circuit board couples to the circuit board interface defined by the conductive material of the substrate.

Oggioni generally relates to Ball Grid Array (BGA) electronic modules and more particularly to a package for High Frequency applications. The package includes a thin dielectric layer 403 that is laid on a metal (e.g. copper) stiffener 401. As indicated by the Office Action, the metal stiffener can act as a heat dissipater for the dielectric layer. Also as indicated by the Office Action, the metal stiffener is connectable to a solder ball, for connection with a mother board, by way of a plurality of metallized photovias.

Oggioni also describes the use of EMI shielding with PBGA packages. For example, Oggioni describes the use of using an all metal cavity package to house the electronic circuit:

In hybrid microelectronic circuits the substrate (usually ceramic) bearing silicon device is glued or brazed to bottom of the

metal package. Then wire bonding interconnections are formed between substrate and package leads. Then the whole module is capped by brazing or welding a cover lid to the open cavity in order to get a one piece all metal package. The EMI shielding is thus obtained by grounding the metal envelope through internal interconnections. (Paragraph 0006).

Also, Oggioni describes the use of a metal fence created along the sides of a substrate by a combination of solder balls and plated through holes to form an EMI shield.

Oggioni, however, does not anticipate the Applicants' independent claims 5 and 14 because the reference does not teach or suggest all of the elements of the claims.

For example, Oggioni does not teach or suggest a metal stiffener "*forming an electromagnetic interference shield when a portion of the circuit board interface connects to a ground reference of the circuit board through the circuit board interface*" as claimed by the Applicants. Oggioni discloses the use of a metal stiffener that can act as a heat dissipater for a dielectric layer of a package. While the Office Action indicates that the metal stiffener of Oggioni is connectable to a solder ball, for connection with a mother board, by way of a plurality of metallized photovias, there is no teaching or suggestion that the metal stiffener can be used as an electromagnetic interference shield *when a portion of the circuit board interface connects to a ground reference of the circuit board*.

Additionally, Oggioni does not recite the use of the metal stiffener to form "*an electromagnetic interference shield*" as claimed by the Applicants. Oggioni does recite the use of an all metal cavity package to house and provide EMI shielding to an electronic circuit. Oggioni also describes the use of a metal fence created along the sides of a substrate by a combination of solder balls and plated through holes to form an EMI shield. In neither case, however, does Oggioni

teach or suggest a "*heat spreader in combination with the heat spreader interface forming an electromagnetic interference shield when a portion of the circuit board interface connects to a ground reference of the circuit board through the circuit board interface*" as claimed by the Applicant.

Because Oggioni does not suggest or disclose every element of the Applicants' independent claims 5 or 14, the claims are patentable over the reference and the rejection of claims 5 and 14 under 35 U.S.C. §102(a) should be withdrawn. Accordingly, claims 5 and 14 are in allowable condition.

As indicated above, claims 6-8 and 10-12, which depend from claim 5, and claims 15-16, which depend from claim 14, were rejected under 35 U.S.C. §103(a) as being unpatentable over Oggioni in view of Takeuchi. Additionally, claim 9, which also depends upon claim 5, was rejected under 35 U.S.C. §103(a) as being unpatentable over Oggioni in view of Takeuchi and further in view of Lee. However, claims 6-12 depend upon allowable independent claim 5 and claims 15-16 depend from allowable claim 14. The rejection of these dependent claims over the cited references is therefore moot and the claims should be allowed to issue for at least the reasons presented above.

Regarding the rejection of independent claim 1, the claim relates to a circuit board module comprising a circuit board having a component mounting location and a circuit board component mounted to the component mounting location of the circuit board. The circuit board component includes a substrate having non-conductive material and conductive material supported by the non-conductive material, the conductive material defining (i) a circuit board interface, (ii) a die interface, (iii) a heat spreader interface, and (iv) a set of connections which interconnects the circuit board interface, the die interface and the heat spreader interface. The circuit board component also includes a die coupled to the die interface defined by the conductive material of the substrate, the die including

integrated circuitry which is configured to electrically communicate with a circuit board when the circuit board couples to the circuit board interface defined by the conductive material of the substrate. The circuit board component also includes a heat spreader coupled to the heat spreader interface defined by the conductive material of the substrate, the heat spreader being configured to dissipate heat from the die, *the heat spreader in combination with the heat spreader interface forming an electromagnetic interference shield when a portion of the circuit board interface connects to a ground reference of the circuit board through the circuit board interface*. The circuit board module also includes a heat sink in thermal communication with the heat spreader of the circuit board component.

Regarding the rejection of independent claim 4, the claim relates to a circuit board module comprising a circuit board having a component mounting location and a circuit board component mounted to the component mounting location of the circuit board. The circuit board component includes a heat spreader configured to dissipate heat from the circuit board component and a substrate having non-conductive material and conductive material supported by the non-conductive material, the conductive material defining (i) a circuit board interface, (ii) a die interface, (iii) heat spreader connecting means for physically and electrically connecting to the heat spreader, and (iv) a set of connections which interconnects the circuit board interface, the die interface and the heat spreader connecting means. *The heat spreader and the heat spreader connecting means form an electromagnetic interference shield when a portion of the circuit board interface connects to a ground reference of the circuit board through the circuit board interface*. The circuit board component also includes a die coupled to the die interface defined by the conductive material of the substrate, the die including integrated circuitry which is configured to electrically communicate with the circuit board when the circuit board couples to the circuit board interface defined by the conductive material of the substrate. The circuit

board module also comprises a heat sink in thermal communication with the heat spreader of the circuit board component.

As indicated above, Oggioni does not teach or suggest "*the heat spreader in combination with the heat spreader interface forming an electromagnetic interference shield when a portion of the circuit board interface connects to a ground reference of the circuit board through the circuit board interface*" as claimed by the Applicants. Furthermore, Takeuchi does not cure the shortcomings of Oggioni.

Takeuchi relates to a semiconductor package having an integrated heat spreader. While the Office Action recites Takeuchi as having a heat sink in thermal communication with a heat spreader (Figure 6), Takeuchi also recites the heat spreader and thermally conductive substrate core as assisting in suppressing electromagnetic emissions from a semiconductor device.

For example, for one embodiment, a metal heat spreader and substrate core may form an electrically conductive enclosure that shields the integrated circuit(s) on all sides, which may reduce electromagnetic interference (EMI) to nearby components. EMI suppression may be especially important if electromagnetic emissions from the integrated circuit are in a frequency range that may interfere with communications equipment. (Paragraph 0027)

Therefore, while Takeuchi discloses a metal heat spreader and substrate core that can form an electrically conductive enclosure that shields an integrated circuit on all sides to reduce EMI, Takeuchi does not teach or disclose "*the heat spreader in combination with the heat spreader interface forming an electromagnetic interference shield when a portion of the circuit board interface connects to a ground reference of the circuit board through the circuit board interface*" as claimed by the Applicants.

Because neither Oggioni nor Takeuchi, either alone or in combination, suggest or disclose every element of the Applicants' independent claim 1 or 4, the claims are patentable over the references and the rejection of claims 1 and 4 under 35 U.S.C. §103(a) should be withdrawn. Accordingly, claims 1 and 4 are in allowable condition. Additionally, claims 2 and 3 which depend from claim 1 should also be allowed for at least the reasons presented above.

#### Newly Added Claims

Claims 21-28 have been added and are believed to be in allowable condition. Claims 21-22 depend from claim 1, claims 23-24 depend from claim 5, claims 25-26 depend from claim 14, and claims 27-28 depend from claim 4. Support for claims 21-28 is provided within the Specification, for example, on page 13, lines 4-22. No new matter has been added.




Conclusion

In view of the foregoing remarks, this Application should be in condition for allowance. A Notice to this affect is respectfully requested. If the Examiner believes, after this Response, that the Application is not in condition for allowance, the Examiner is respectfully requested to call the Applicant's Representative at the number below.

The Applicants hereby petition for any extension of time which is required to maintain the pendency of this case. If there is a fee occasioned by this response, including an extension fee, that is not covered by an enclosed check, please charge any deficiency to Deposit Account No. 50-3661.

If the enclosed papers or fees are considered incomplete, the Patent Office is respectfully requested to contact the undersigned collect at (508) 616-2900, in Westborough, Massachusetts.

Respectfully submitted,

  
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